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Connecting earth and sky: Persuading climate skeptics through analogy

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ABSTRACT

Many Oklahomans agree that the disposal of produced water in deep injection wells contributes to the increased rate of seismicity in the state. However, a portion of this same population disagrees that greenhouse gas emissions contribute to climate change. Part of this difference can be explained as an effect of the combination of a particular cultural model of nature and Oklahomans' relative insulation from the effects of climate change. This article suggests that scientific communication structured around an analogy drawn between the causes of induced seismicity and climate change may be an effective way to invite this population to reconsider their beliefs about climate change and nature. The argument is developed with a discussion of cultural models as examples of analogic thinking and the role of analogies in cognition and learning. Although this is a preliminary framework for communicating with a specific population, a similar approach may also prove useful in communicating with other climate change skeptics.

1. Introduction

I was asleep in Stillwater, Oklahoma, when I woke to a popping sound and then the sensation of my bed shaking. It was an earthquake, a 4.1 magnitude temblor whose epicenter was about 25 miles to the north. Oklahoma has experienced a dramatic increase in earthquakes since 2009 due to the injection of wastewater (a product of oil and gas extraction) into deep disposal wells (Weingarten et al., 2015). Oklahoma's oil and gas industry uses disposal wells because most production wells in the state produce more water than oil or gas (Langenbruch and Zoback, 2016) and the water is too saline for use in agriculture or elsewhere (Clark and Veil, 2009, Pica et al., 2017). It is possible to treat produced water to make it suitable for other uses, but the cost and logistics of such an effort makes disposal wells an attractive choice (Xu et al., 2008).

Although many of these induced earthquakes are low in magnitude, they can hurt people and damage property (Yeck et al., 2017). These quakes, however, are not the only threats facing Oklahoma. The state is already experiencing long-term environmental changes, such as drier soils and increased rainfall, due to climate change (Environmental Protection Agency, 2016). By the middle of the century, droughts will be more severe and widespread; rain, when it does come, will likely be torrential and increase the risk of flooding (Shafer et al., 2014). Induced seismicity and climate change represent consequences at the opposite ends of the fossil fuel supply chain. The earthquakes are related to extraction activities and climate change is primarily driven by the greenhouse gasses released by burning fossil fuels (Leibensperger et al., 2012, Rosenberg et al., 2010, U.S. Global Change Research Program, 2017).

Oklahoma's people and government have a close relationship with the fossil fuels industry. The initial oil boom of the early 1900s financed development in the state (Boyd, 2002) and the modern industry generates 25% of the state's tax receipts and is connected to the employment of 20% of Oklahomans (Snead and Jones, 2016). The oil and gas industry has contributed much to the state, but there is, perhaps, another unexpected contribution it can make.

It may be possible to persuade a particular stripe of climate change skeptic by using Oklahoma's induced seismicity as an analogy for climate change. Here, I present a tentative argument for how this may be possible using a chain of reasoning from a variety of social sciences interspersed with survey data from Oklahoma. The survey data is a product of the Oklahoma NSF-EPSCoR project (National Science Foundation Grant No. OIA-1301789) and was collected by the Center for Risk and Crisis Management at the University of Oklahoma.[1]

2. Climate skepticism as a cultural model

There are at least 29 psychological barriers that inhibit climate change adaptation activities (Gifford, 2011). The type of barrier that may be amenable to persuasion by analogy for some Oklahomans is the one Gifford has labeled "suprahuman powers." People with this barrier see a deity (for religious people) or Mother Nature (for secular people)

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[1] The survey data and additional information is available at http://crcm.ou.edu/epscor/

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as responsible for the condition of the Earth. In this viewpoint, the deity or Mother Nature, which may or may not be nurturing, are unmoved by human intervention. Whether through religious or secular reasoning, the outcome is the same—inattention to and inaction on climate issues. I have often encountered this barrier during interviews about climate change opinions. It can appear in ways that match Gifford's description almost verbatim and more subtly through assertions that weather patterns are cyclical, such as the excerpted quote below from an interview conducted as part of the Oklahoma NSF-EPSCoR project.

> I think [severe storms] have been there since the beginning of time and we are going to still see those. I don't think they are going to get any worse. They may be a little bit worse one year, not as bad the next year. That's the cycle.

That is, a period of challenging weather will shift to one more benign later.

Gifford does not provide estimates for the prevalence of each barrier, but survey results from Oklahoma suggest the "suprahuman powers" barrier is common. Respondents were asked to identify whether they hold a hierarchical, individualistic, egalitarian, or fatalistic view of the world. Results from the survey show that a plurality of respondents, 44%, holds individualistic worldviews. The worldview choices provided to the respondents are drawn from the work of Thompson et al. (1990), which is based on Mary Douglas' (2011) grid-group typology. Each worldview is associated with a corresponding "myth of nature" that must be true in the holder's mind in order for the worldview to be rational (Thompson et al. (1990:26). Individualists believe that nature remains in equilibrium no matter what humans do to it. The "suprahuman powers" barrier maps well onto this concept.

For this reason, I suggest a more useful way to think about the "suprahuman powers" barrier is not as a psychological one, but as a manifestation of a cultural model. (Gifford classifies this barrier as a worldview, so perhaps he would not argue with me on this point.) Holland and Quinn describe cultural models, sometimes called schemas, as the "presupposed, taken-for-granted models of the world that are widely shared (although not to the exclusion of other, alternative models) by the members of a society and that play an enormous role in their understanding of that world and their behavior in it" (1987:4). Or to paraphrase, a cultural model is not what one sees, but what one sees with (Holland and Quinn, 1987:14).

As such, cultural models have a powerful influence on cognition (D'Andrade, 1992). People use their cultural models to justify the status quo and bring clarity to new and uncertain situations (D'Andrade 1990:156). As the cultural model researchers Strauss and Quinn (1997:49) note, "Without these learned expectations regarding the way things usually go, it would be impossible to get anything done, plan for the future, or even interpret what is happening." How people react to and classify new situations is always informed by their previous experience (Strauss and Quinn 1997 :25–26). At the same time, cultural models may be revised when new situations arise. The utility of thinking in terms of cultural models rather than barriers is that cultural models, although durable, are flexible, whereas barriers smack of permanence.

Despite their potential flexibility, cultural models that prevent or discourage adaptation to climate change persist. This is, in part, because they represent the culturally correct answer for interpreting the world, but do not necessarily correspond to the actual cause of an event or its implications. Another reason is that climate change is still a psychologically distant issue for many people (McDonald et al., 2015). Psychological distance is a concept for measuring how close to the self a person perceives an event to be in terms of the event's likelihood of happening, the length of time until it might happen, the geography it might happen in, and whether the people it might happen to are like the observer or not.

For many Westerners, climate change is usually psychologically distant on all these dimensions. They are not feeling its effects (yet), because their technology and economic arrangements, and the fact that most Westerners do not live in marginal or vulnerable ecosystems, insulate them from the rapid changes occurring to people elsewhere, such as the Sakha of northeastern Siberia (Crate, 2008) or the Marshallese of the equatorial Pacific Ocean (Rudiak-Gould, 2014). It is difficult for the average Oklahoman, for example, to identify an effect of climate change in the state. This combination of durable cultural models and economically- and technologically-cushioned psychological distance means that many Westerners have not meaningfully encountered the effects of climate change. Further, confronting climate skeptics with direct arguments (i.e. scientific information) often has the opposite effect of entrenching their current views (Drummond and Fischhoff., 2017).

If cultural models can be maladaptive and persist despite growing scientific evidence, what hope is there of convincing climate skeptics in Oklahoma, who believe that human activity cannot influence the environment, that anthropogenic climate change is happening? I suggest the answer lies in analogy. Drawing an analogy between induced seismicity and anthropogenic climate change may create a wedge that can slip under the dome of denial that deflects direct approaches on skeptics' positions. In the balance of this essay, I will discuss analogies, their role in learning and persuasion, the population in Oklahoma for which an analogy might be effective, and the analogy I am proposing.

3. Induced seismicity as an analogy for climate change

An analogy is a logical argument that posits a similarity of relationships across heterogeneous domains of experience (Whaley and Babrow, 1993). Analogies have the general formulation of A is to B as C is to D. They are favored persuasive techniques in the legal profession (Berger, 2013, Ching, 2010), but they are more than a courtroom device. Hofstadter (2001), a cognitive scientist, believes analogies to be the core of cognition. He describes how hearing a news story about a people's forced migration evokes the concept "ethnic cleansing," although the term did not appear in the story. This example demonstrates vividly how we quickly and unconsciously apply known concepts to new situations. Importantly, this mapping of information from past to novel experiences, from the known to the unknown, that Hofstadter argues is the basis of how we think, reveals the application of cultural models to be complex examples of analogic thinking.[2]

Despite the analogic foundation of human thinking, the efficacy of analogies in persuasion is mixed (Whaley et al., 2014; Whaley and Babrow, 1993). However, their use in science education is successful if employed with care (Aubusson et al., 2006; Duit, 1991). The goal of using analogies in science education is to apply knowledge about the relationship between entities in a known domain to a relationship in an unfamiliar domain (Gentner, 1983; Gentner and Markman, 1997; Newby and Stepich, 1987). A popular analogy in physics education, for example, compares how electricity moves through a battery-operated direct current circuit with how water moves through a pump-driven pipe circuit. In this analogy, the dynamics of water, which are likely more familiar to most students, illustrate the dynamics of the electrical circuit, which students are just learning.

This brings me to my main point. If we conceptualize Oklahoma's climate skeptics as learners rather than recalcitrant deniers, we not only respect their agency and cultural models, but can also use analogy to communicate with them using knowledge they already hold. We can invite them to examine their cultural models instead of assuming they suffer under the burden of an impenetrable psychological barrier. However, the success of the analogic approach depends on learners' ability to draw from a reference domain. This condition exists among some Oklahoma residents.

[2] Interestingly, the implicit assumptions that indicate the presence of a cultural model can be identified through an informant's use of analogies to explain the world (Ryan and Bernard, 2003).

Survey results indicate that 63% of respondents, including a majority of respondents in each political party except Republican-leaning Independents, believe human activity is the cause of the recent increase in earthquakes. The same survey shows that 60% of respondents (the majority of respondents in each political party, other than Republican and Republican-leaning Independents) accept mainstream climate science and believe that greenhouse gasses, released by the combustion of fossil fuels, cause global average temperatures to rise. The intersection of the two groups reveals that 15% of respondents think that wastewater injection is responsible for the increased rate of earthquakes, but do not believe in anthropogenic global warming. Of this group, 55% (or about 8% of the total population of the state) hold the individualistic worldview that may be amenable to change through analogy.

The analogy I am proposing is: wastewater injections are to induced seismicity as greenhouse gas emissions are to climate change. This analogy maps relationships between Earth and Sky, which are heterogeneous cultural domains for many people (Iwaniszewski, 2011). It also draws from a familiar domain to illustrate relationships in an unfamiliar one. Although climate change has been a major public policy concern since the 1980s (Trumbo, 1996), and induced seismicity in Oklahoma has only been recognized for a decade, it is actually climate change that represents the unknown domain due to the aforementioned cultural models and psychological distance. Earthquakes, on the other hand, are psychologically near and Oklahomans have recognized why they are occurring.

In the proposed analogy, it is unimportant that not all of the features from the example domain correspond to the target domain (Gentner, 1983). For example, consider the analogy: a cat is to a mouse as a dolphin is to a mackerel. Cats and mice are both terrestrial mammals but dolphins are marine mammals and mackerels are not mammals at all, but fish. In this analogy, the important relationship is that each pair is hunter and prey. The information my proposed analogy seeks to transfer is that human activity can have negative effects on the Sky as it does the Earth. It is not important that wastewater injection is a purposeful activity whereas greenhouse gas emissions are relatively passive or that wastewater is a byproduct of energy production and greenhouse gasses are largely the result of energy consumption. In fact, induced seismicity and climate change are both “techna disasters,” those natural disasters triggered by human activity (Gill and Ritchie, 2018). If this analogy is successful, those 8% of Oklahomans who accept anthropogenic seismicity, but reject anthropogenic climate change based on their individualistic myth of nature, may rethink their positions.

4. Conclusion

There are several questions to be answered about how the analogy will be communicated to Oklahomans and why they should consider it, particularly given that environmental topics are dominated by ideology (Corner et al., 2014; Gromet et al., 2013; McCright and Dunlap, 2011). Literature on communication about disaster preparedness, a historically difficult endeavor, could provide helpful guidance (e.g. Yong-Chan and Jinae, 2010). Fortunately, it appears that well-constructed analogies enhance the credibility of communicators (Whaley and Babrow, 1993). Further, any communication should draw upon Oklahomans’ connection to their state and the emotional reaction they may have felt in response to the earthquakes. Although the analogy may succeed in causing them to evaluate their cultural model for climate change, for the revised model to acquire motivational force it needs to be connected to an emotional response (D'Andrade, 1995; Holland and Quinn, 1987; Mathews, 2005). Indeed, what is often lacking in science communication is not facts, but resonance with the emotions and values of the audience (Dietz, 2013).

All of the above is tentative—not the individual theories, but their deployment in the manner I am suggesting. Further research is required. Even so, I believe it is a matter worth pursuing because of what is at stake. The purpose of this idea is not to castigate Oklahoma’s extractive industries nor Oklahomans themselves. Rather, the goal is to encourage more Oklahomans to consider mitigatory measures for the impending challenges to environment and society that climate change represents. Preparing for the effects of climate change will, in the end, protect the positive contributions from the oil and gas industry that Oklahomans enjoy. However, it is first necessary to acknowledge the risks.

Although the 8% of Oklahomans who acknowledge induced seismicity but not anthropogenic climate change due to their cultural models may seem like a small population to target, it is actually over 323,000 people. Not all of those people will be convinced—even in the best-case scenario—but it may not take many changed minds to have an effect on climate policies in Oklahoma. Despite the state’s notoriety as the incubator for such famous climate skeptics such as Scott Pruitt (current director of the EPA) and Senator James Inhofe, the majority of Oklahomans (60%), including 37% of Republicans and 41% of Republican-leaning Independents accept mainstream climate science. It is not improbable that a relatively small shift in some Oklahomans’ cultural models could make climate change politically impossible to ignore. Such a shift in Oklahoma could be an important turning point for climate policy in the United States. That would be another welcome, if unexpected, contribution from Oklahoma’s oil and gas industry.

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